

COVID-19 and SARS-CoV-2
Infection Prevention and Control
J Conly

25

Faculty/Presenter Disclosure

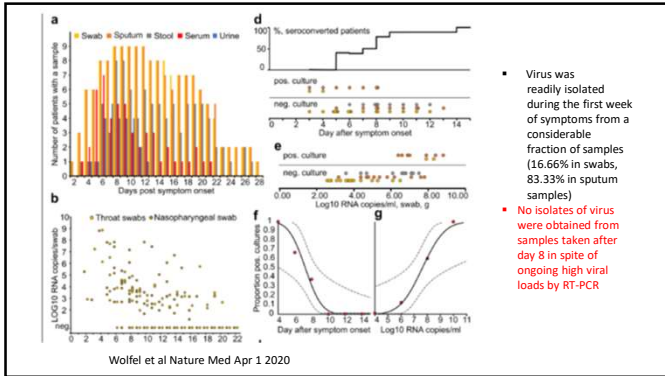
- **Financial disclosure affiliations – John Conly :**
 - **Honoraria:** None
 - **Speakers' Bureaux, advisory boards:** Received funding to attend a meeting on HAI from the CDC and bioMerieux
 - **Grants/Clinical Trials:** Local PI for the STRIVE *S. aureus* vaccine trial spinal surgery (Pfizer) and holds grants from CIHR, AI-HS, PHAC, AH, AHS, EDT.
 - **Patents, royalties:** None
 - **Investments in health organizations:** None
 - **Other influential affiliations:** Member of committees with PHAC, WHO and CIHR

26

State of the art SARS-CoV-2

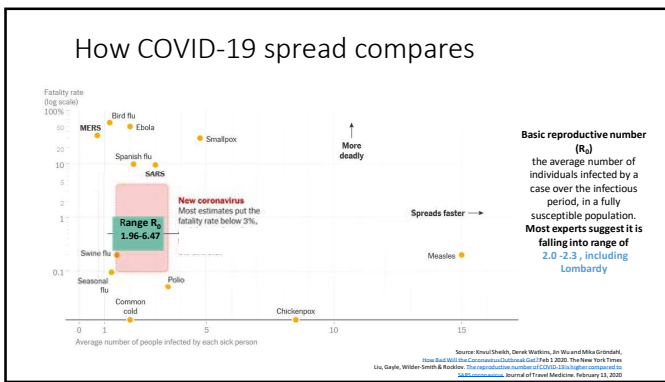
- **Environmental specimens**
 - 585 samples collected from 2 batches of South China Seafood City (sampling on 1/1/20):
 - PCR tests showed that 33 samples + for SARS-CoV-2 nucleic acid
 - N-CoV was successfully isolated from + environmental specimens as well (ProMed)
- **Patient specimens**
 - BAL samples (Zhu NEJM) + viral isolation
 - Nasopharyngeal/oropharyngeal (NP/OP) swabs + multiple studies
 - Serum (Lancet 2020) + one patient and
 - Stool RNA in the of infected patients (ProMed, Holshue NEJM 2020) and 1/3 of patients in the WHO –China Joint Mission
 - Exact duration of shedding not known with certainty
- **Healthcare workers (HCWs)**
 - 7% HCW infections reported in a series of 425 Chinese patients from Wuhan (Li, NEJM)
 - Vast majority before outbreak recognized and most transmissions were at home
 - Multiple HCWs reported confirmed cases inside and outside of China
 - In a single-center series n= 138 hospitalized cases in Wuhan, China, **presumed hospital-related transmission** of SARS-CoV-2 was suspected in 41% of patients (Wang, JAMA).
 - Recent paper Wuhan (CID March 2020) single highest RR was poor HH/poor adherence to technique despite full PPE use

27



- Virus was readily isolated during the first week of symptoms from a considerable fraction of samples (16.66% in swabs, 83.33% in sputum samples)
- No isolates of virus were obtained from samples taken after day 8 in spite of ongoing high viral loads by RT-PCR

28



29

State of the art - evidence from SARS-CoV and MERS-CoV relevant to IPC

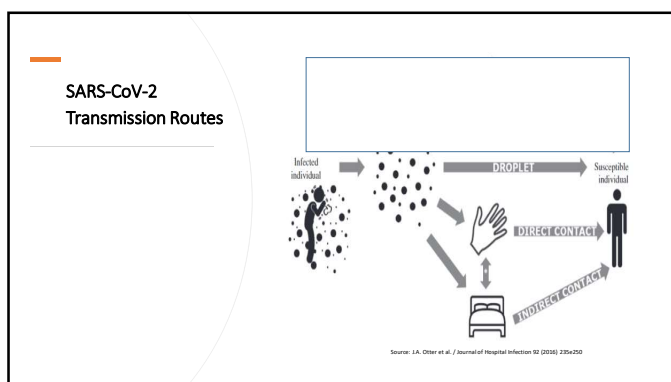
- **Droplet and contact** – multiple studies demonstrated **compliance with gloves, gowns and medical masks or N95s** were adequate to prevent transmission for SARS; **major risks** exposure of eye and mucous membranes to **resp secretions and AGMPs**, ie intubation (**opportunistic airborne**); no association with contact with urine/stool
- **HCW spread** - associated with **inconsistent or improper PPE use** for SARS/MERS-CoV outbreaks; Infections in HCWs: **22% and 25%** for SARS and MERS, respectively
- **Risk factors for nosocomial spread** of MERS-CoV in two large outbreaks in Saudi Arabia and South Korea found ER/Ward **overcrowding and sub-optimal control of visitors** were factors
- **Transmission of MERS-CoV was not documented** in an investigation of mostly **asymptomatic and pauci-symptomatic** cases and their household contacts
- **Asymptomatic cases uncommon** – one study of MERS cases found **80%** of “asymptomatic” persons actually had symptoms on close questioning

Seto WH et al Lancet 2003; Raboud J et al Plos One 2010; Jefferson et al Cochrane Rev 2011; Oboho IK et al NEJM 2015; Kim SW CID 2017; Cheng VC et al Antiviral Res 2013; Van Kerkhove MD et al Sci Rep. 2019.

30



31



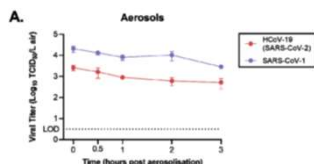
32

Table 2. Environmental and PPE sites sampled and corresponding RT-PCR Results

Site*	Positive samples (patient C, before routine cleaning)**	Cycle threshold value*
Environmental sites*		
Patient's room		
1. Cardiac table, holding handle	1/1	35.44
2. Entire length of bed rail	1/1	37.95
3. Control panel on bed	0/1	
4. Call bell attached to bed	0/1	
5. Locker with hand size	1/1	36.21
6. Chair	1/1	37.07
7. Light switches behind bed	1/1	37.54
8. Stethoscope	1/1	38.24
9. Sink, external rim	1/1	35.54
10. Sink, internal bowl	1/1	36.79
11. Floor	1/1	30.64
12. Glass window in room	1/1	35.79
13. Glass door interior	1/1	35.71
14. PPE storage area over sink	1/1	34.89
15. Air outlet fan	2/3	32.96, 37.94
Toilet area		
16. Door handle	1/1	35.63
17. Toilet bowl, surface	1/1	37.75
18. Hand rail	0/1	
19. Sink, external rim	0/1	
20. Sink, internal bowl	1/1	37.11

Qing SW et al. Air, Surface Environmental, and Personal Protective Equipment Contamination by SARS-CoV-2 from a Symptomatic Patient March 4 Online JAMA 2020

Van Dorsselaer et al Aerosol and surface stability of HCoV-19 (SARS-CoV-2) compared to SARS-CoV-1. NEJM online March 17 2020



- New publication released week of March 16, 2020.
- Creating a stir on social media that COVID-19 is airborne
- Used a 3 jet nebulizer /drum and 10 ml sample skin to a "bomb" of the virus and demonstrated dispersal
- **No correlation whatsoever to the clinical setting and does not simulate coughing** - a system used for bio-terrorism studies

33

Building upon key existing WHO guidance

Infection prevention and control during health care when novel coronavirus (nCoV) infection is suspected
Interim guidance
25 January 2020

Home care for patients with suspected novel coronavirus (nCoV) infection presenting with mild symptoms and management of contacts
Interim guidance
20 January 2020

Advice on the use of masks in the community, during home care and in health care settings in the context of the novel coronavirus (2019-nCoV) outbreak
Interim guidance
29 January 2020

https://www.who.int/csr/bioriskreduction/infection_control/publication/en/
Seto WH, Only JM, Pessoa-Silva et al EMJH 2013

37

Table I
Persistence of coronaviruses on different types of inanimate surfaces

Type of surface	Virus	Strain / isolate	Inoculum (viral titers)	Temperature	Persistence	Reference	
Steel	MERS-CoV	Isolate HCoV-EMC/2012	10 ⁷	20°C	48 h	[11]	
	TGEV	Unknown	10 ⁶	30°C	8–24 h	[12]	
	MHV	Unknown	10 ⁷	4°C	> 28 d	[12]	
				20°C	3–28 d	[12]	
Aluminum	HCoV	Strain 229E	10 ⁷	21°C	2 d	[13]	
		Strains 229E and OCA3	5 x 10 ⁷	21°C	2–3 h	[14]	
	SARS-CoV	Strain P9	10 ⁷	RT	5 d	[15]	
	SARS-CoV	Strain P9	10 ⁷	RT	4 d	[15]	
	SARS-CoV	Strain P9	10 ⁷	RT	4–5 d	[15]	
	SARS-CoV	Strain GUK109	10 ⁷	RT	24 h	[16]	
	Glass	SARS-CoV	Strain P9	10 ⁷	RT	< 5 min	[15]
		HCoV	Strain 229E	10 ⁷	21°C	5 d	[13]
	Plastic	SARS-CoV	Strain HKU109/09	10 ⁷	22–25°C	< 5 d	[17]
		MERS-CoV	Isolate HCoV-EMC/2012	10 ⁷	20°C	48 h	[11]
PVC	SARS-CoV	Strain P9	10 ⁷	RT	8–24 h	[15]	
	SARS-CoV	Strain P9/01	10 ⁷	RT	4 d	[18]	
	HCoV	Strain 229E	10 ⁷	RT	6–9 d	[13]	
	HCoV	Strain 229E	10 ⁷	21°C	5 d	[13]	
Silicon rubber	HCoV	Strain 229E	10 ⁷	21°C	5 d	[13]	
	HCoV	Strains 229E and OCA3	5 x 10 ⁷	21°C	< 9 h	[14]	
Disposable gown	SARS-CoV	Strain GUK109	10 ⁷	RT	2 d	[16]	
	HCoV	Strain 229E	10 ⁷	RT	24 h	[13]	
Ceramic	HCoV	Strain 229E	10 ⁷	21°C	1 h	[13]	
	Teflon	Strain 229E	10 ⁷	21°C	5 d	[13]	

Kampf et al. Persistence of coronaviruses on inanimate surfaces and its inactivation with biocidal agents. Journal of Hospital Infection. 2020

MERS – Middle East Respiratory Syndrome; HCoV – human coronavirus; TGEV – transmissible gastroenteritis virus; MHV – mouse hepatitis virus; SARS – Severe Acute Respiratory Syndrome; RT – room temperature.

38

Table III
Inactivation of coronaviruses by different types of biocidal agents in carrier tests

Biocidal agent	Concentration	Virus	Strain / isolate	Volume / material	Organic load	Exposure time	Reduction of viral infectivity (log ₁₀)	Reference
Ethanol	71%	TGEV	Unknown	50 µl / stainless steel	None	1 min	3.5	[19]
	71%	MHV	Unknown	50 µl / stainless steel	None	1 min	2.0	[19]
	70%	TGEV	Unknown	50 µl / stainless steel	None	1 min	3.2	[19]
	70%	MHV	Unknown	50 µl / stainless steel	None	1 min	2.9	[19]
	70%	HCoV	Strain 229E	20 µl / stainless steel	5% serum	1 min	> 3.0	[40]
	62%	TGEV	Unknown	50 µl / stainless steel	None	1 min	4.0	[19]
Benzalkoniumchloride	62%	MHV	Unknown	50 µl / stainless steel	None	1 min	2.7	[19]
	0.04%	HCoV	Strain 229E	20 µl / stainless steel	5% serum	1 min	< 3.0	[40]
	0.35%	HCoV	Strain 229E	20 µl / stainless steel	5% serum	1 min	> 3.0	[40]
	0.1%	HCoV	Strain 229E	20 µl / stainless steel	5% serum	1 min	> 3.0	[40]
Sodium hypochlorite	0.008%	TGEV	Unknown	50 µl / stainless steel	None	1 min	0.4	[19]
	0.04%	MHV	Unknown	50 µl / stainless steel	None	1 min	0.6	[19]
	0.01%	HCoV	Strain 229E	20 µl / stainless steel	5% serum	1 min	< 3.0	[40]
Glutaraldehyde	2%	HCoV	Strain 229E	20 µl / stainless steel	5% serum	1 min	> 3.0	[40]
	0.55%	TGEV	Unknown	50 µl / stainless steel	None	1 min	2.3	[19]
Ortho-phthalaldehyde	0.55%	MHV	Unknown	50 µl / stainless steel	None	1 min	1.7	[19]
	0.55%	TGEV	Purdue strain type 1	20 µl / stainless steel	None	2–3 h	4.9–5.3*	[41]

TGEV – transmissible gastroenteritis virus; MHV – mouse hepatitis virus; HCoV – human coronavirus; *depending on the volume of injected hydrogen peroxide.

Kampf et al. Persistence of coronaviruses on inanimate surfaces and its inactivation with biocidal agents. Journal of Hospital Infection. 2020

39
